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News Bulletin of The Entomological Society of Victoria Inc.

THE ENTOMOLOGICAL SOCIETY OF VICTORIA (Inc)

MEMBERSHIP

Any person with an interest in entomology shall be eligible for Ordinary membership. Members of the Society include professional, amateur and student entomologists, all of whom receive the Society's News Bulletin, the Victorian Entomologist.

OBJECTIVES

The aims of the Society are:

(a) to stimulate the scientific study and discussion of all aspects of entomology,
(b) to gather, disseminate and record knowledge of all identifiable Australian insect species,
(c) to compile a comprehensive list of all Victorian insect species,
(d) to bring together in a congenial but scientific atmosphere all persons interested in entomology.

MEETINGS

The Society's meetings are held at the 'Discovery Centre', Lower Ground Floor, Museum Victoria, Carlton Gardens, Melway reference Map 43 K5 at 8 p.m. on the third Tuesday of even months, with the exception of the December meeting which is held on the second Tuesday. Lectures by guest speakers or members are a feature of many meetings at which there is ample opportunity for informal discussion between members with similar interests. Forums are also conducted by members on their own particular interest so that others may participate in discussions.

SUBSCRIPTIONS (2010)

Ordinary Member	$30 (overseas members $32)
Country Member	$26 (Over 100 km from GPO Melbourne)
Student Member	$18
Electronic (only)	$20
Associate Member	$ 7 (No News Bulletin)
Institution	$35 (overseas Institutions $40)

Associate Members, resident at the same address as, and being immediate relatives of an ordinary Member, do not automatically receive the Society's publications but in all other respects rank as ordinary Members.

LIFE MEMBERS: P. Carwardine, Dr. R. Field, D. Holmes, Dr. T. New, Dr. K. Walker.

Cover design by Alan Hyman.

Cover photo: *Megaceria* sp. *VE 41 (2) p39*
Photographer John Tiddy, a member of the Victorian Nature Photography Group with an interest in insects, has provided this photo using a white background photography technique. In this case the wasp has it's abdomen elevated due to the cold weather when it was found. An article expanding on this method of photography is included in the February 2011 bulletin.

Notes from Members Meeting 16th August 2011

Peter Marriott opened the meeting

Apologies

Jim Tuttle, Ian Endersby, Margaret Endersby, Steve Curle, Daniel Dobrosak, Linda Rogan

Present

Peter Marriott, Ken Harris, David Stewart, Margaret Kesauan, Marilyn Hewish, Wendy Moore. Axel Kallies, Peter Lillywhite, Joshua Grubb, Tiziano Barberi, Mark Norman, Peter Carwardine

Peter Marriott spoke on The Society's relationship with Parks Victoria. Currently members provide lists and information to Parks Vic as a condition of collecting permits. It is hoped that we may be able to have a greater involvement and have Parks Vic call upon the Society to provide some appropriate entomological expertise when it is needed.

Guest Speaker: Dr. Mark Norman, Head of Sciences at Museum Victoria.

Mark gave a report on the recent 'Bush Blitz' project.

Bush Blitz is an ABRS funded initiative where experts are encouraged to do a rapid biodiversity study of a targeted region. This particular Blitz was at Lake Condah in the South West of Victoria. This was the first of the Bush Blitz's to look at an area of reserve under the care of traditional owners. The museum were the major group involved but they had contributions from the University of NSW, The Victorian Herbarium, The South Australian Museum and four members of the Vic Ent Soc, as well as help from a team of indigenous rangers from the park.

The important thing to come out of the talk was that the Museum would like to have an ongoing relationship with the society. The Museum will be looking at Wilsons Promontory for two weeks from 17th Oct 2011 under the auspices of Parks Victoria and will be doing another ABRS Bush Blitz in November 2011 up at Ned's Corner on the Murray in North West Victoria. Mark extended a welcome and an invitation to interested members of the society to come and be a part of these two projects. At this stage they (the Museum) envisage members participating two and three at a time.

Productive discussion around this followed.

Joshua Grubb gave a PowerPoint presentation on some of the entomological finds from the Lake Condah Bush Blitz. See some of Joshua's photos on page 86 and 97.

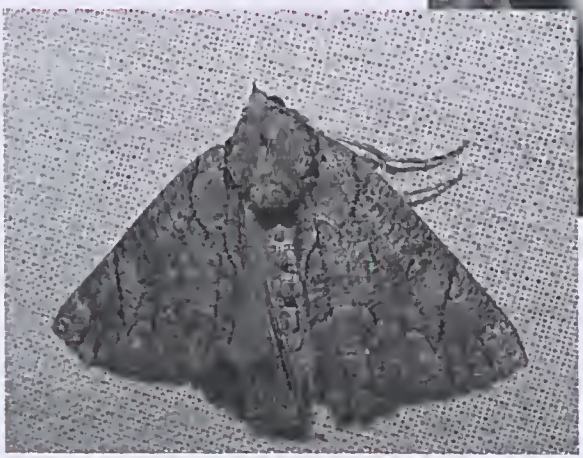
Peter Marriott also gave a PP presentation based on his and Marilyn Hewish's time at Lake Condah. Peter's talk focused on the moth fauna. Some 200 species of Lepidoptera and by-catch have been identified so far from their collecting.

Meeting closed.

Photos from the August Bush Blitz at Lake Condah

by Joshua Grubb

Wolf spider (Lycosidae) emerging from its burrow. wolf spiders were one of the focal taxonomic groups of the Bush Blitz (right)



Heliomystis eletrica, attracted to the lights near base camp (left)

Convolvulus Hawk Moth - *Agrius convolvuli* larva (below left) adult on light sheet (below right)

Minutes of the Council Meeting 20 September 2011

The meeting was opened at 17:10

Present: P. Carwardine, S. Curle, I. Endersby, M. Fiedel, P. Lillywhite, P. Marriott, L. Rogan

Apologies: D. Dobrosak

Minutes: Minutes of the Council Meeting of 17 May 2011 [Vic. Ent 41(3): 63-4] were accepted (P. Marriott; I. Endersby)

Correspondence:

(a) 10th Invertebrate Biodiversity & Conservation Conference to be held in conjunction with the conference of the Society of Australian Systematic Biologists to be held in Melbourne in December 2011 Details at http://ibcc2011.org

(b) Peter Marriott had sent a message to those for whom we have an email address, advising that members are invited to participate in an invertebrate survey to be conducted by Melbourne Museum and Parks Victoria at Wilson's Promontory from 16-28 October, 2011. To date eight members have expressed interest.

(c) Parks Victoria is calling for nominations for Kookaburra Awards to be made to individuals or groups which have made an outstanding voluntary contribution to the Victorian park system. Council could not identify a suitable recipient.

Council decided that in future it would not record in the minutes correspondence the subject of which had expired by the time that the *Victorian Entomologist* was received by Members. Such time-sensitive items would be distributed by email and on the Facebook facility

Treasurer's Report:

Account balances at the end of August 2011 were General Account $6,249; Le Souëf Award Account $5,504; Publishing Account $13, 932. Eight members are still unfinancial.

Editor' s Report:

No new illustrations have been submitted for the cover of next year's newsletter. A further call will be made but the style could depend on a decision to print the journal with colour options for all pages.

It is planned for the December issue to include colour photographs.

Enough articles are available for the October issue, which we also contain detailed instructions for the December meeting which is to be a barbeque and light trapping evening to be held in conjunction with the Friends of Warrandyte State Park.

Mike Halsey has proposed a regular article News from the North East
Everyone is delighted at the concept and await further details.

NEW MEMBERS

We welcome the following new members to the Society:
Stephen Williams, Strathfieldsaye, Vic. (Moths)
Laura Quinn, Echuca, Vic (IPM, Forensics, Biosecurity)
Benjamin Goonan, North Bendigo, Vic (Entomology)
(Mr) Mikiya Horie (and sons) Chatswood, NSW (butterflies)

(Continued on page 88)

(Continued from page 87)

General Business:

Dec 4th Conference (see page 107)

Colour Printing

Investigations into local printing options reveals that no one can provide the value that we have seen from Impact Digital.

Impact Digital will deliver to where we need it to be delivered, would provide a colour print on semi gloss pages, with the cover the same weight paper as magazine.
The front page image now has an opportunity to vary and promote the society in colour. Members are requested for thoughts and perhaps images for future publications.

It was moved that next year we move to a full colour publication for each edition and that we endeavour to cover this without increasing membership fees; it will be reasonably lightweight cover (same thickness as rest of paper); stapled, trimmed and delivered.

Publications

MOV 3 is out, 340 distributed.
MOV1 down to last 40 copies.
MOV5 about 1/3 of the way through
MOV6 about 1/3 completed
MOV7 about 50% completed
CSI Sold around 300

We are looking to publish other orders and would like to hear from our members that may like to fill some of the many gaps in published Victorian invertebrate literature.

Previous issues

Wings n Stings pdf's – all now searchable in the original format.
For a copy please contact the treasurer.

Parks Victoria

If people are interested in liaising with Parks Victoria with any of their projects and feel that we may be able to assist; please contact the Secretary where we may be able to assist and facilitate.

Meeting ended 18.42

Next Meetings

October **18th** General meeting with members presentation
November 15th Council meeting
December **13th** General meeting, BBQ and light trapping (details page 98)

Observations on Carrying Pair Behaviour among Asia-Pacific Butterflies:

Part IV (More Field Diary Records - Lycaenidae)

Kelvyn L Dunn
e-mail: kelvyn_dunn@yahoo.com

Summary: This report documents 26 observations of mating butterflies, involving seven (7) species of Lycaenidae (three Theclinae & four Polyommatinae), all compiled from within the Australia-Pacific region. Carrier selections, mating times, a general description of the habitat and biological notes are included for each encounter. And, in passing, three *tridomyrmex* ant taxa (Dolichoderinae) are newly recorded as attendants on juveniles of one *Jalmenus* species. Strong selection forces have evidently operated on the majority of butterfly groups during their evolutionary history to make the choice of carrier, whether female (ancestral) or male (derived), a fixed component; meaning that it is largely invariable as the norm rather than the exception. However, one Australian species where selection of the derived carrier-state remains in flux – some 74% of couples were carried solely by the male – is discussed in light of further evidence supporting carrier inconsistency across couples and alternation within a few (14%) of its couples.

Introduction

Over the years I have compiled carrier details for 115 matings pairs, involving 62 butterfly species in the Australia-Pacific region (Dunn 2000, 2005, & 2009). This fourth paper adds 26 new encounters and so strengthens the baseline data. Most records come from mainland Australia with regional others from the Solomon Islands. Each record variably details the couples' behaviour (alignments and carriers), heights and lengths of flights, landing substrates and their elevation, as well as any other relevant biological data (including habitat, ambient temperature and weather conditions) that seemed noteworthy at the time. Cross comparison is drawn between some examples to give insight into behavioural trends. In general, the results from the Southern Hemisphere, reported in this and my earlier reports, corroborate the foundational conclusions of Shields and Emmel (1973) whose findings focussed on records from the Northern Hemisphere. Despite the varied geographic origins of the butterfly groups, carrier selections have carried through as a largely fixed component of behaviour.

Coitus in butterflies can take several hours (depending on the species involved) and in one or more species may require nightfall for completion (Svard & Wiklund 1988). Hence, as in previous parts, the times given for each encounter specify the time of discovery of the couple (not the time of coital commencement or the duration of coituses). Times of encounter across the region have been aligned by conversion of all Daylight Saving Times (**DST**), which is used seasonally in some Australian states (or parts thereof), to the local Standard Times. The times provided from beyond Australia are based on the times used in the countries of origin. The Solomon Islands was not using DST during my visit so local midday (1200h) would likely approximate with a solar noon, thus enabling congruence with the Australian records, should this information prove meaningful.

Regional abbreviations: Queensland (**Qld.**), New South Wales (**NSW**), Victoria (**Vic.**), Northern Territory (**NT**), Western Australia (**WA**). Time zones: Australian Eastern Standard Time (**AEST**), Central Standard Time (**CST**) used in NT, Australian Western Standard Time (**AWST**), Australian Central Western Time (**ACWT**) (the latter are both used in WA); Solomon Islands Time (**SBT**). Other abbreviations: Carrying Partner (**CP**), Male (**M**), Female (**F**); Video images obtained (**V**). Taxonomy: subspecific names are included only for those records from beyond Australia where taxonomies may be less stabilised and synonymies less clear.

Primary mating observations (Lycaenidae)

Theclinae

Jalmenus evagoras – Heany Park hilltop, Rowville, Vic., **Australia**, 06 Dec 2007, 1200-1220h AEST. **CP=F** (4 couples involving 5 flights). Habitat: scrubby woodland regrowth (within a firebreak bisecting eucalypt forest). Weather: Sunny, hot, 30°C. Four couples were on foliage of an almost stripped *Acacia mearnsii* (Mimosaceae) shrub of 2m height. Stems swarmed with small black ants of *Iridomyrmex obscurior* which were attending larvae and clusters of pupae as well as treehoppers (*Sextius virescens*). These particular ants emitted a pungent odour (somewhat similar to that of *Anonychomyrma* spp.) The attendant ant species – unlisted by Eastwood and Fraser (1999) for this butterfly and hence a new attendance record – ignored all settled adults they streamed past, irrespective of whether those adults were ovipositing, perching or mating in their immediate vicinity and foraging area.

Of the four couples seen, those freshly emerged females whose wings had expanded and were capable of flight carried the suspended worn and tattered males, and landed more or less uppermost each time. In general though, copulating couples were reluctant to fly. When prompted by tactile disturbance from the observer, they flew rapidly at 1-2m height above ground for about 10m or more. None returned to the same plant once disturbed and instead selected other plants nearby; one pair landed on a chicken-wire fence that it had intercepted during flight. Mating procedure: Two females whose wings were unexpanded were each courted simultaneously by two males. The successful males of the two courtiers grasped the female's abdomen with his abdominal claspers enforcing copulation, seemingly without a courtship. Unsuccessful male competitors continued, albeit briefly, to wave their abdomens intrusively in an attempt to copulate with those females that were already engaged in mating. Those two females, being still effectively flightless at that time, could not engage in a conjugal flight and so remained stationary at the site of mating. Disturbance of these couples could not force an alternative male carrier-selection or coital cessation.

J. evagoras – Stony Creek, 10km by road WNW of Nowa Nowa, Vic., **Australia**, 26 Jan 2008, 1045h AEST. **CP= F** (2 flights). Habitat: heath verge in open eucalypt forest. Weather: sunny, hot. Couple perched on 2m high *A. mearnsii* shrub, this being the larval host plant. Male: moderate condition. Female: fresh condition. The associated ant *Iridomyrmex mattiroloi splendens* Forel, 1907 tended the butterfly larvae on foliage and stems [Voucher: CSIRO Acc. No. 32-042460]. The attendant ant variety – unlisted by Eastwood and Fraser (1999) at this taxonomic level – is a new association record for juveniles of this butterfly.

J. evagoras – Sardine Creek crossing, Bonang Hwy, 37km by road NNE of Orbost, Vic., **Australia**, 26 Jan 2008, 1100-1110h AEST. **CP=F** (3 couples: first couple undertook one flight; second couple separated on disturbance; and third couple was sedentary: the female was newly emerged with still expanding wings, being flightless). Habitat: riparian woodland. Weather: sunny. All couples had mated on *Acacia dealbata*, one of two larval hosts utilised at this site (the other being *A. mearnsii*). The ant *Iridomyrmex mattiroloi splendens* tended larvae on the foliage and stems of the *A. dealbata* [CSIRO Acc. No. 32-042458].

J. evagoras – Tonys Creek, 2km by road SSW of Goongerah, Vic., **Australia**, 26 Jan 2008, 1220h AEST. **CP seemingly F** (1 flight). Habitat: dry sclerophyll open forest. Weather: sunny. Couple perched on *A. mearnsii*, the larval host-plant at the site. Adult condition unrecorded. Small black ants similar to those sampled at other sites that same day attended the larvae (they were probably *Iridomyrmex mattiroloi* but no samples were taken).

J. evagoras – Wonboyn River, 9km in beeline WNW of Wonboyn Village, NSW, **Australia**, 2 Feb 2008, 1435 AEST. **CP seemingly F** (1 flight). Habitat: wet sclerophyll open forest. Weather: sunny. Larger adult in good condition and almost certainly female, carried smaller, older adult, seemingly the male. Couple perched on 2m high *A. mearnsii*, the larval host-plant at the site. Coital pair seemed very wary; it

flew immediately on observer's approach, covering 70m, and upon landing was lost amongst shrubbery. Its rapid departure precluded certain identification of the carrier. The ant *Iridomyrmex mattiroloi splendens* attended the larvae on the foliage and stems [CSIRO Acc. No. 32-042454].

J. evagoras – 4km by road south of Big Flat Creek crossing, near Wangarabell, Vic., **Australia**, 11 Dec 2009, ca. 1300 AEST. **CP=F** (2 flights). Habitat: roadside shallow gully adjacent sclerophyll forest. Weather: sunny period, 22°C. Couple found perched in full sunshine, with female (the carrier) uppermost atop ca. 1.5m high *A. mearnsii*, this being the larval host-plant at the site. It next settled near top of small shrub before returning (after third disturbance) to same larval host plant on which it was first seen. Upon each landing, both sexes held wings closed (routine in this species). Coital pair seemed wary and usually flew on very close (but still beyond arms reach) approach of observer; as observer advanced to encourage a third flight (fourth disturbance), it separated at (or immediately after) take-off. Female (the larger of the two) was in fresh condition; moderately worn male remained suspended with legs tucked up during coitus. The ant *Iridomyrmex victorianus* attended the many larvae and pupae clustered amidst empty pupal shells on a stem fork, only a few millimetres beneath where the mating couple perched motionlessly and which the festoon of ants regularly passed by. Counts (achieved from video frames) revealed ant-attendance levels at about 12-16 per larva and about 5 per pupa. About 40 butterfly juveniles stages and pupal shells had aggregated on the stem fork where the couple had perched, inferring (by computation) the presence of some 300 ants on a stem section covering merely 10cm in length. Other large clusters were present elsewhere on the shrub, associated with stripped foliage linked to extensive caterpillar foraging. Carefully examined video evidence showed that the swarming ants seemed oblivious to the coupled pair perched amidst them **[V]**. The attendant ant species – unlisted by Eastwood and Fraser (1999) – is a new association record for juveniles of this butterfly.

Jalmenus inous – Mundaring Weir WA, **Australia**, 01 Nov 2008, 1205 AWST (locally 1305h WA-DST). **CP=F** (3 flights). Habitat: dry open forest. Weather: sunny. Copulated smallish female (of the local form with the well-marked underside that occurs in this area) was more or less positioned uppermost, some 2m up on the wattle stems. In flight she consistently carried her moderately sized male mate. Couple repeatedly settled on larval host, an *Acacia* sp. determined as "most likely" *A. saligna* (M. Williams pers. comm. 2009) [V]. Host was swarming with ants (*Iridomyrmex rufoniger*), and eggs as well as a few larvae of the butterfly were present on stems. (Several males periodically patrolled about base of wattle – a known mate location strategy in species where pupation occurs amongst leaf litter – others perched on the host (or adjacent shrubs overlooking host). For lengthy periods though, no adults were seen near the plant, evidently having dispersed elsewhere within a large home range or remained undetected close by).

Hypochrysops apelles – Codhole Park, Fishermans Rd, Maroochydore, Qld., **Australia**, 14 Apr 2007, 1605h AEST. **CP=F** (most probably) (1 flight). Habitat: Estuarine mangroves. Female: fresh condition (male condition unrecorded). Conjugal pair disturbed into flight from canopy of mangroves (*Avicennia sp.*), some 5-8m above ground, by aerial movement of a hoop net. Couple descended and landed 1m above ground on stem of mangrove sapling, fortuitously close beside observer. Male initially attempted to align uppermost by beginning to turn slightly, but female instead forced herself uppermost and male submitted to that alignment. Observer disturbed couple to prompt a second flight; male fluttered rapidly but female did not comply with a departure. Couple separated after further attempts to coax a flight. Male's fluttering behaviour – rather than suggesting a carrier in this instance – was probably an attempt to assist the female's departure flight. Similar uplifting behaviour occurs among the Hesperiinae (Dunn 2003) and so I suspect that where a carried partner (rather than the carrier – the dominant adult) is repeatedly disturbed, early cessation of copulation may result as part of escapism. (Compare with the *Z. labradus* couple from Belgrave Vic. (described later) in which the carried adult, albeit female in that instance, similarly departed first). As with the other Theclinae (*Jalmenus* spp. documented above) mating appeared linked to a site of emergence and/or oviposition; the white mangrove is a larval host plant of this Jewel butterfly.

Polyommatinae

Nacaduba berenice – Mt Coot-tha Botanic Gardens, Qld., Australia, 15 Feb 2008, 1500h AEST. **CP=M** (4 flights). Habitat: parkland. Weather: overcast with sunny periods. Brief courtship flight above herbs. Fresh-conditioned but relatively small female landed on horizontal foliage of herb, but did not flutter, flick, or fan her wings to signal the usual rejection. Worn male perched adjacent settled female; situated on her right-hand-side and partly behind, facing same direction as she. Both adults remained with wings closed. Male promptly curled abdomen to copulate. Upon linkage, male walked around sideways, and clockwise to about 180°, to face in opposite direction to female. Male carried when couple was disturbed. He landed uppermost each time initially on grass or herbage near ground level but gained increasing elevation with later flights. Following the fourth flight the couple settled on foliage some 2m above ground. Increased perch height after repeated disturbance was likely linked to escapism. Dunn (2002) described another conjugal pair of this species and similarly reported a male carrier; in that example the female was initially uppermost upon copulation but walked to realign the couple rear to rear, thereby positioning the male as uppermost on an oblique substrate.

Nacaduba biocellata – Kalbarri National Park: 300m NE of 'Z-bend (west entry) pay station', about 11km ENE of Kalbarri township, WA, Australia, 14 Nov 2008, 1405h AWST (locally 1505h W-DST). **CP=undet** (3 flights). Habitat: heath-land. Weather: sunny. Couple settled 1m above ground on sunlit narrow phyllode of wattle (*Acacia* sp.), which was then neither budding nor in flower. Both sexes held wings closed during copulation. Couple initially undertook two short flights to nearby foliage but on a third disturbance (caused by wind) couple was lost from sight. Its early escape, linked to a lengthy flight following repeated interference, meant that the carrier's sex was not determined with any certainty.

N. biocellata – 14km by road east of Cocklebiddy, WA, Australia, 25 Nov 2008, 1615h ACWT (locally 1715h CW-DST). **CP=M** (2 flights). Habitat: mallee woodland. Weather: sunny. Couple settled on wattle (*Acacia* sp.). They were situated 2m above ground on sunlit foliage; the male was uppermost and both sexes held wings closed. Larger male in moderate condition, smallish female appeared older and with a prominently enlarged abdomen. Couple initially undertook a short flight, but on second disturbance covered about 40m, flying variably 1-2m above ground, and crossing the highway where after it was lost from sight. It is likely that the lengthy subsequent flight was linked to escapism but absence of a suitable substrate may have influenced this in part. Females were flying abundantly about this budding wattle, and some adults (almost certainly males) were patrolling near the ground beneath it – a known mate location strategy in this species. This suggests that mating was associated with a site of emergence or oviposition.

Zizula hylax (ssp. *dampierensis*) – Poha River, about 3km NW of White River, Guadalcanal, The Solomon Islands, 03 Aug 2005, 1305h SBT. **CP=F** (3 flights). Weather: sunny. Habitat: riparian woodland near secondary rainforest verge. Male: small, very worn (obviously aged). Female: typical size, fresh condition. Couple perched on leaves of yellow-flowering herb growing adjacent rural pathway near secondary forest. Couple landed a second time, about 1m above ground, on blade of tall grass of similar growth form and appearance to common Guinea grass (*Panicum* spp). Female landed uppermost with legs held in wide stance (thereby lowering her centre of gravity and so providing maximal support). She was identified in the field as the carrying adult with ease and certainty. Smaller male partner remained quiescent, his legs slightly withdrawn below thorax (providing minimal support), but still balancing himself on leaf surface **(V)**. Like most other butterfly species, both adults remained stationary during coitus unless disturbed.

Z. hylax (ssp. *dampierensis*) – Lambete village, Munda, New Georgia, The Solomon Islands, 07 Aug. 2005, 1015h SBT. **CP=F** (2 flights). Habitat: shore scrubland. Weather: overcast with sunny periods. Couple perched with closed wings more-or-less horizontally aligned (neither partner being uppermost) on tips of erect, vertical pinnules of bipinnate shrub and was situated low to ground **(V)**. The larger, fresh-conditioned adult was determined in the field as the carrier on both flights. Later examination of video images clarified the larger adult's sex as female.

Zizina labradus – Berwick Vic. **Australia**, 14 Jan 2006, 0920h AEST. **CP=mostly M** (14 flights observed: male carried on 11 flights, female carried on 3). Habitat: residential garden. Weather: 13°C (80% humidity). Male: the smaller of the two, very aged. Female: typical size, fresh condition. Male carried (despite small size) on first nine consecutive flights. Couple was rested for four (4) minutes and then disturbed again, whereupon the female carried for three of next five flights. After each of these five flights, the couple settled with the male (not the female) aligned uppermost, suggesting that the male was the dominant carrier for that coupling despite the fact that the female had carried on those three occasions. The longest distance, which covered 10m (measured) involved the female carrier (but as a later flight following repeated disturbance it was potentially escapist in nature). After 14 flights, couple refused to fly thereafter and subsequently dropped/walked lower to seek refuge amidst grass blades where they remained secreted in coitus (see below for similar example from Belgrave in 2011). Secretion in dense vegetation may be a penultimate strategy (one short of cessation of mating – see example below from Arthurs Seat in 2011) to avoid detection when a lengthy escapist flight has failed to deter a potential predator.

Z. labradus – Churchill National Park Vic. **Australia**, 9 Nov 2007, 1440h AEST. **CP=M** (2 of 3 flights). Habitat: parkland adjacent dry eucalypt woodlands. Weather: sunny, 26°C. Male: moderate condition, female: small, old and tattered. Couple settled in sunshine on lawn grass and on a fallen, dry eucalypt leaf. The male carried on at least two of the three flights observed; the carrier of the final flight remained uncertain but was likely the male again (given the physically weaken state of this particular female). This was probably a second (or later) mating for the aged female partner.

Z. labradus – Doctors Gully, Larrakeyah NT, **Australia**, 27 May 2008, 1455h CST. **CP=M** (3 flights). Habitat: parkland on cliff edge near vine-thicket. Weather: sunny, 33°C. Male: fresh condition. Female: old and tattered with multiple chips to both hind-wings. Adult sizes not recorded (presumably similar and unremarkable). Couple found in sunshine on low decorative herbage in garden setting. The fresh-conditioned adult settled uppermost upon each landing, and both adults rested with closed wings. Sex determinations required confirmation by in-hand examination due to poor condition of female, making her sex determination visually ambiguous in the field, however her distinctiveness (wing wear) clearly identified her as the carried adult on each of the three flights studied. Another unusual pairing in terms of wing condition; and similar to the example above, this was presumably a second or later mating for the aged female partner.

Z. labradus – Wentworth Falls, NSW, **Australia**, 21 Dec 2009, 1200h AEST. **CP=undet** (2 flights observed but a 2m high, chicken-wire fence prevented close examination of couple, thwarting determination of the carrier's sex). Habitat: grassy roadside verge adjacent highway. Weather: Hot and sunny. Larger adult, positioned uppermost on grass, carried smaller worn adult. Both adults had settled in full sunshine with wings closed (typical of the species in copulation). A larger carrier is not indicative of the likely sex in this species as both small and large adults may carry. On the balance it was probably a male carrier (given the 3:1 chance calculated – see Discussion). However, of the three occasions in this paper where females had carried, two of those females had been the larger adult in the coupling. (In earlier papers in this series where the female of this species had been reported as having carried, the relative sizes of the adults involved had not been documented).

Z. labradus – Berwick, Vic., **Australia**, 16 Jan 2010, 1030h AEST. **CP=mostly M** (11 flights observed: male carried on the first 9 flights, female carried on the following 2). Habitat: garden. Weather: Hot and sunny, 32°C (10% humidity). Male: good condition, slightly smaller than female. Female: fresh condition, regular size. Couple encountered flying low above lawn. It landed on Iris lily stem with male uppermost. Couple examined in hand (by gently securing male forewing apexes with forefinger and thumb and by use of a fine pointer to expose the hind-wing upper-sides) to confirm sex. Male was then marked, by rotating fingers gently removing a large patch of scales on forewing undersides, to assist carrier determinations on subsequent flights. Couple (which appeared undisturbed by this handling and was presumably at an early stage in the mating sequence) was returned to foliage and then prompted into flight by nudging

with observer's forefinger. Over the next 10 minutes the male carried on eight consecutive flights (ranging in distance from 1 to 8m and varying from ground level on the lawn to 1m in height). Couple remained quiescent when undisturbed, although during copulation, on one occasion only, male's hind legs stroked backward towards his posterior, with muscular contractions of his abdomen evident much of the time. Two prongs were conspicuous below the genitals, moving rhythmically with these contractions.

Male (marked adult) consistently landed uppermost; female could not be enticed to fly when in the lower position. Reversing alignment, by bending substrate to make female uppermost, merely enticed realignment of couple: the male walked and rotated couple to revert the couple alignment on the stem. Couple then coaxed onto sheet of white paper (outdoors) and kept horizontal to observe alignment behaviour. At 1040h female then became the active walker; she turned couple (still on near horizontal paper substrate, to align herself as slightly uppermost) and the male cooperated, passively accepting the changed alignment. Tilting the paper confirmed the new alignment as intentional as female rotated couple to retain her uppermost position. Female (the unmarked adult) then flew and carried male on next two flights, aligning herself as uppermost upon landing both times. At 1050h, and without obvious disturbance, male walked downward (in opposite direction to stationary female), ceasing copulation on own accord. Male then walked slowly around, moving anticlockwise, and subsequently walked upward alongside female, briefly contacting her antennae (with his own) in passing. Now facing the same direction, he departed upward by flight. Female remained settled on substrate (paper sheet) with wings closed, for about 10 seconds longer, then also departed without prompts. She landed about 10 metres away on shrubbery, whereupon she moved her hind-wings in a typical lycaenid figure '8' pattern by undulation. Moments later, she flew to depart the area. The removed scales on the male's wings confirmed (without doubt) that alternation of carriers had occurred in this couple. The male appeared the dominant carrier though, as was the case also in the couple observed in Berwick Vic in 2006 (documented above) and two of the couples seen in 2011 (see below), but it is possible that alternation was linked to continued disturbance. Both adults kept wings closed above the thorax throughout the mating sequence (typical of the species).

Z. labradus – Arthurs Seat, at summit lookout, Vic. **Australia**, 15 Jan 2011, 1330h AEST. **CP= mostly M.** Habitat: open eucalypt woodland. Weather: sunny, 28°C. Male: moderately worn. Female: smaller, fresh condition with brownish hue to underwings surface, contrasting shiny silver tone of male. The couple was first seen in flight. It quickly landed in sunshine on grass stems about 30-60cm above ground; the female had settled uppermost and was (almost certainly) the carrier on that first flight. After the observer's close intrusion, the male then carried consistently; he landed uppermost each time; and both sexes remained with wings closed once landed. The male, as the regular carrier (he had carried on 6 of the 7 flights observed), was then examined in the hand and his sex confirmed. However, mating ceased abruptly once the male – the larger adult – was secured (with his forewings gently held closed between fingers) and at which time the female, presumably greatly alarmed, speedily departed by escapist flight.

Z. labradus – 3km by road WSW of Nyora, Vic. **Australia**, 27 Jan 2011, 1250h AEST. **CP=M** (male by inference, 2 attempted flights). Habitat: remnant woodland near rural area. Weather: sunny, 24°C. Male: worn. Female: smaller, fresh condition. Couple found settled in sunshine, about 40-60cm above ground, on tall grass stem. Its near horizontal alignment on a curved grass stem and bridging a spent seed-head made carrier identification ambiguous, nonetheless male was slightly raised above the female (by several millimetres) albeit lower on the stem itself. Mating may have occurred on the stem, but had they alighted there whilst in copulation then the male would have landed lowermost suggesting the female had carried. Observer disturbed the couple by moving a finger to within 10cm (no contact). Alarmed by intrusion, the male (the supposed carrier) immediately fluttered his wings rapidly (in process confirming his sex) and in doing so attempted to uplift the female, but she held the substrate. A second disturbance, some 10 seconds later (and again without physical contact) saw the same behaviour repeated. The male quickly fluttered and became airborne, hovering several millimetres above the stem, still in

copulation, but within a second or so mating ceased; one sex released the other. The male departed rapidly, flying parallel the ground at same height as the perch. The female, which had refused a carried flight on both occasions, remained settled on the stem. Her continued presence at the site suggests a timely completion of mating (unlike the previous example where the female fled). It does not suggest reluctance to fly (as might occur in a perceived threatening situation) as females are usually quiescent, remaining behind briefly, once mating has ceased.

Z. labradus – Belgrave at Trestle Bridge, Vic. **Australia**, 07 Apr 2011, 1320h AEST. **CP=M** (4 flights). Habitat: open forest. Weather: sunny, 24°C. Male: moderate wear. Female: smaller, seemingly in fresh condition. Couple found settled in sunshine, positioned horizontally about 80cm above ground on tall flower head (Asteraceae) amidst long grass. Couple flew short distance (1-3m) to another sunlit grass stem. On approach of observer, it flew again but rapidly dropped height. It then landed merely 30cm from previous perch, this time in a partially shaded, dense grass thicket, seemingly in an effort to secrete itself (see also earlier example from Berwick in 2006). Two minor flights of several centimetres within thicket then followed, but the couple seemed reluctant (or perhaps unable) to escape the tangle. Male aligned uppermost on stem each time. Upon very close inspection, the female separated from male and both adults departed more or less at once. This atypical closure, in absence of female quiescence, suggests untimely completion of copulation (see above example from near Nyora in 2011). Cessation was likely linked to a perceived threatening situation, that being the unabated intrusive presence of observer in association with a degree of natural entrapment.

Discussion

It is presupposed that in their selection of a carrier partner a moderate number of couples might fall somewhere between an ancestral state (that being a female carrier – often the larger adult in the ancient groups) and the diametrically opposite, a derived state (that being a male carrier). Drivers for change to the derived state, which has occurred in some groups, remain unclear but what is clear is that natural selection has strongly enforced uniformity irrespective of the sex utilised. For this reason whole subfamilies are often immutably fixed in their choice of carrier (eg Danainae), indicating that carrier selection evolved very early in lepidopteran lineages. Given general inflexibility then, evidence of alternation of carriers, seen among a very small number of select species and on rare occasions within some couples (see Dunn 2000, 2005 & this paper for regional examples), stands as a behavioural peculiarity.

For one Australian species, *Zizina labradus* – a widespread taxon that some authorities now treat (again) as a subspecies of *Z. otis* (Yago *et al.* 2008) – the situation seems complex. Orr and Kitching (2010) illustrated one example they had encountered and assumed a male carrier was the norm (and quite reasonably too, given that global trend among the Polyommatinae). The data suggest, however, that in *Z. labradus* selection of the male as the carrier, although commonly the case, is a facultative response rather than an obligatory one. As the facts stand, 14 (74%) of the 19 mating couples of this butterfly (where a carrier sex was identified and where that sex was the sole carrier of the couple; this paper included) were carried by a male. Scoring the dominant carrier in alternating couples too restores the sample size to the full complement (n=22) but may over-emphasise male-carrier utilisation (77%). Perhaps then, as a population, *Z. labradus* is still evolving a bias towards the derived character-state; alternatively, it could be reverting from a formerly fixed (or near fixed) derived state to the ancestral one (an obligatory female carrier). Whatever the explanation for this skew away from carrier polarisation, the bias stands at about 3:1 (M: F) – in close agreement with the preliminary estimation of 2:1 from a smaller sample (Dunn 2000) and estimation of 2:1 for the subfamily as a whole (Dunn 2005).

The data in Shields and Emmel (1973) indicate that alternation of the carrier within couples is an extremely rare event. Among the plethora of species they studied it was reported only in one species of Nymphalinae and two species of Polyommatinae. The three examples (this paper) of alternation

within couples in Z. *labradus* (excluding an earlier circumstantial case (see Dunn 2005) which may have involved two couples; and assumed the case for the purposes of this count) represent 14% of the 22 couples documented to date (where a carrier was determined). This seems unusually high on probability. However, assuming field identifications are accurate (given the difficulty in sexing individuals of this small species whilst mating) it could be that the percentage of couples that can alternate likely do so in response to a perceived threat or stressful disturbance. This explanation is the classic belief (Shields & Emmel 1973) but it is also possible that it is regular practice within this species rather than exceptional. Why reversal to a female carrier might be a better choice in times of duress or for an escapist flight seems unclear, unless for reason that it is the ancestral trait and, having a very strong survival advantage, was effectively selected for among butterfly groups at that earlier time. Choice of a larger carrier (often the female butterfly) does make sense in minimising work effort (less resource expensive) but in the Polyommatinae the female may not be the larger adult and, conversely, a smaller or even aged male may repeatedly carry.

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Orcus australasiae Photos by Joshua Grubb

With representatives of its entire life cycle, found on Cherry Ballart (*Exocarpos cupressiformis*) at Lake Condah

Eggs (above)

Larva emerging (right)

Pupal case (above)

Adult (right)

F.O.W.S.P.

Invitation to a light trapping event at Pound Bend Indigenous Nursery Warrandyte State Park Tuesday 13th December 2011

BBQ
Arrive from 6:30 for BBQ

At 8:00 a brief Ento meeting
will be followed by an evening of light trapping
and learning about some of the insects of WSP

Bring

Own meat and drink for BBQ

Torch for getting about at night

Enthusiasm for insects

FOWSP members will provide salads and dessert to share

See Melways maps
23 C 10 and 35
approach via Pound Rd or
Everard Drive

Pound Bend Road is narrow
so drive slowly

RSVP Name and numbers
Linda Rogan 9435 5806
or lindarogan@netspace.net.au
before 11th December

A combined event for Entomological Society of Victoria and
insect keen members of Friends of Warrandyte State Park and wider community

The Pacific damsel bug, *Nabis kinbergii* in Tasmania

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This article presents evidence for frequent migration of Pacific damsel bug (PDB) from mainland Australia to Tasmania but whether this significantly influences seasonal abundance in Tasmanian crops cannot be determined from this data. Records in the Tasmanian Plant Pest Database (TPPD), mainly reflecting specimens held by the Department of Primary Industries Parks, Water and Environment, Tasmania (DPIPWE), data from a light trap at Devonport for the period 2000 to 2006 and 2010-11 and some field observations are examined.

Woodward and Strommer (1982) clarified the name of *Nabis (Tropicoanabis) kinbergii* Reuter, which is widespread in Australia and in the same subgenus as the pantropical pale damsel bug, *Nabis capsiformis* Germar, which is not known from Australia. Several *Nabis* species are significant in North American and European agriculture but only PDB appears significant in Australian agriculture despite mention of the possibility of an undescribed dark species by Gross (1963). The Australian Faunal Directory lists only two other Nabidae for Australia, namely *N.* (*Australonabis*) *biformis* Bergroth 1927 from New Zealand and south-east Australia and *N.* (*Australonabis*) *fraternus* Kerzhner 1970 from Tasmania.

Reviews by Lattin (1989) and Breman (2000) show that *Nabis* is an important predator in agriculture. More recently, Ma *et al.* (2005) and Nguyen (2008) reported on the diet and behaviour of *N. kinbergii* in Australia. Lattin summarised literature on flight, dispersal and wing polymorphism, most notably the airborne records and remote insular occurrences of *N. capsiformis* presented by Kerzhner (1983). This purely macropterous species clearly undertakes major dispersal around the tropical zone but nothing seems documented about similar movements by PDB, another macropterous species unlike many overseas temperate species with small distributions.

Overwintering usually seems to occur in the adult stage. Southwood (1960) reported small captures of the macropterous *Nabis ferus* (Linnaeus) in light traps at Rothamsted, UK as 2, 0, 1, 0, 0, 0, 11, 47, 15, 0, 4 and 7 for the 12 months from January to December respectively for the years 1946-9. He said the early autumn peak coincided with the maturation of the single generation and suggested that individuals caught in the cold season, November to March, may have walked into the trap rather than flown. Rohitha *et al.* (1985) reported that PDB was more common on New Zealand lucerne in autumn than spring.

The TPPD contains 93 records for PDB of which 88 are based on specimens in 41 series in the DPIPWE collection (New Town, Hobart). The earliest specimen was deposited by A.M. Lea in 1911 at the end of his term as government entomologist. The second oldest specimen is an adult from silver wattle (*Acacia dealbata*) in Launceston, September 1965. Subsequent specimens date from 1974 and many coincide with surveys of lucerne crops in response to the appearance of two new aphid pests. Overall, adult specimens were collected between December and July from carrot, green beans, lucerne, red clover, onion, potato, pyrethrum, storksbill (*Erodium moschatum*), sweet corn, wheat as well from silver wattle (*Acacia dealbata*) in September. The 15 or so localities include northern, southern and eastern Tasmania.

In Victoria, both adult and nymphs can be found in winter and spring, sometimes in very high numbers where the plants have been present since the previous summer, such as strawberries, grassland and capeweed. They are frequently encountered in carrot crops (Paul Horne and Jessica Page, pers. comm.). The only Tasmanian nymphal specimens in the collection were swept from the foliage of commercial carrot crops at Kindred in May and July of 1986 suggesting that overwintering may occur in warmer districts of Tasmania.

The scarcity of specimen-based records for spring suggests the population may be absent or very low in that season or may simply reflect cursory collecting over many decades. Nguyen (2008) showed that PDB tends to be more active at night so low spring populations in Tasmania could easily be overlooked. Intensive suction-sampling and destructive visual inspections in a sequence of nine adjoining iceberg lettuce crops spanning October 2004 to April 2005 at Forthside, north-west Tasmania (Hill et al., 2006) did not detect damsel bugs until mid-December despite an abundance of small cutworm larvae as potential prey in the early plantings. Similar sampling of open-heart lettuce crops spanning the following growing season at Richmond, south-east Tasmania, and iceberg lettuce crops at Campania, south-east Tasmania, first detected damsel bugs in January in open-heart lettuce and in oats adjoining iceberg lettuce in March and May but they were not abundant.

A 160W mercury vapour Rothamsted-style light trap at Stony Rise, Devonport provides one measure of PDB activity in Tasmania from 2000 to 2006 and again 2010-11. This trap is 1.5m above ground at 60m elevation about 5km south of Bass Strait. It was serviced at irregular intervals of one to several days and the catch data is summarised in weekly format in Table 2. Sex ratio was not determined at time of capture but 32 specimens in 18 series from the trap, spanning 1994-2005, retained in the DPIPWE collection include 8 males and 24 females. Most major catches occur between December and March with substantial variation across years. Closer analysis of 44 of the 83 weeks yielding catches, including consideration of daily data whenever available, shows that all catches coincided with northerly airflows, the appearance of known migratory or non resident species and often with substantial aerial disturbance on the mainland arising from tropical cyclones (TC) or strong low pressure systems, most frequently in the northwest of the continent generating major troughs towards the southeast. These 44 weeks are described below after listing the coincidental species in Table 1. Some background on these species was presented in Hill (2011). Gregg *et al.* (1993) also list likely migrant species. Fourteen of these are asterisked in Table 1 while several listed by them and which occurred coincidentally in the Stony Rise catches described below were not included in this analysis because of uncertainty about their validity as indicators of migration.

Table 1. Species known or suspected to be regular migrants or vagrants to Tasmania. Asterisks indicate species regarded as migrants by Gregg *et al.* (1993)

Family	genus	species	author	common name
Noctuidae	Aedia	leucomelas	(Linnaeus)	eastern alchymst
Noctuidae	Agrotis	infusa	(Boisduval)	common cutworm*
Noctuidae	Agrotis	ipsilon	(Hufnagel)	black cutworm*
Noctuidae	Agrotis	munda	Walker	brown cutworm*
Noctuidae	Alapadna	pauropis	Turner	
Noctuidae	Athetis	tenuis	(Butler)	
Noctuidae	Australothis	rubrescens	(Walker)	Indian weed caterpillar*
Noctuidae	Chasmina	pulcra	(Walker)	
Noctuidae	Chrysodeixis	argentifera	(Guenée)	tobacco looper*
Noctuidae	Chrysodeixis	eriosoma	(Doubleday)	green looper*
Noctuidae	Chrysodeixis	subsidens	(Walker)	Australian cabbage looper*
Noctuidae	Cosmodes	elegans	(Donovan)	green blotched moth*
Miridae	Creontiades	dilutus	(Stål)	green mirid

Noctuidae	Crioa	hades	(Lower)	
Noctuidae	Diatenes	gerula	Guenée	
Noctuidae	Earias	heugeliana	Gaede	rough bollworm
Noctuidae	Ectopatria	paurogramma	(Lower)	
Noctuidae	Helicoverpa	punctigera	(Wallengren)	native budworm*
Noctuidae	Helicoverpa	armigera	(Hubner)	corn earworm*
Noctuidae	Heliothis	punctifera	Wallengrem	
Pyralidae	Hellula	hydralis	Guenée	cabbage-centre grub
Sphingidae	Hippotion	scrofa	(Boisduval)	scrofa hawk moth*
Noctuidae	Hypoperigea	tonsa	Guenée	
Chrysopidae	Mallada	sp.		green lacewing
Hemerobiidae	Micromus	tasmaniae	(Walker)	brown lacewing
Noctuidae	Mataeomera	dubia	Butler	scale-eating caterpillar
Noctuidae	Mythimna	convecta	(Walker)	common armyworm*
Lygaeidae	Nysius	vinitor	Bergroth	Rutherglen bug
Noctuidae	Persectania	ewingii	(Westwood)	southern armyworm*
Noctuidae	Persectania	dyscrita	Common	inland armyworm
Plutellidae	Plutella	xylostella	(Linnaeus)	diamondback moth
Noctuidae	Prometopus	inassueta	Guenée	
Noctuidae	Proteuxoa	oxygona	(Lower)	
Noctuidae	Proteuxoa	ochrias	(Turner)	
Noctuidae	Proteuxoa	poliocrossa	(Turner)	
Noctuidae	Rhapsa	eretmophora	Turner	
Noctuidae	Rhodina	falculalis	Guenée	
Noctuidae	Thysanoplusia	orichalcea	(Fabricius)	soybean looper*
Arctiidae	Utetheisa	pulchelloides	Hampson	heliotrope moth

Composition of catches and coincident weather

Of 83 weekly catches in Table 2, (page 105)the circumstances of 44 are expounded below. This includes all major catches and many of the minor catches.

15-21 January 2000: Catches of PDB occurred over several nights during the fast passage of several cold fronts across Tasmania behind a trough extending north-westerly to Alice Springs. The catches coincided with catches of *C. elegans, R. falculalis, H. hydralis, D. gerula,* a few *H. punctigera* and a small peak of *P. xylostella.*

In the subsequent three weeks to 11 February 2000, TC Kirrily and severe TC Leon formed north-west of Port Hedland but travelled south-westerly and did not cross the coast although three long troughs extending south-easterly across Western Australia accompanied their extinctions. In this period coincidental catches included *U. pulchelloides, Hippotion scrofa, M. dubia, A. leucomelas, A. tenuis, P. ewingii, C. argentifera, A. infusa, A. munda, H. punctigera, P. xylostella* as well as, on 3-4 February 2000, dozens of *N. vinitor* and *M. tasmaniae.*

During the week 26 February to 4 March 2000, severe TC Norman formed off Port Hedland and headed west but an associated trough extended well south-easterly and crossed Tasmania ahead of a cold front on 2 March coincidentally with catches of five PDB. In the following week 5-11 March, TC Steve formed at Port Hedland and travelled south along the coast before turning inland. This fortnight saw a substantial peak of PDB associated with *U. pulchelloides*, *A. tenuis*, *C. elegans*, *E. huegeliana*, *Hippotion scrofa*, *P. poliocrossa*, *C. argentifera*, *C. eriosoma*, a peak of *P. ewingii* (102 on 10-13 March) and several *A. munda* and *H. punctigera*.

The week 9-15 April 2000 yielded five PDB on the night of 13 April as a long front extending as far north as Alice Springs crossed Tasmania at 25 knots. *U. pulchelloides* and *A. tenuis* coincided with this catch which occurred as severe TC Paul formed well off the north-west Australian coast and headed west. The next and last cyclone in that season was TC Rosita which formed on 17 April and headed south-easterly crossing the coast near Port Hedland on 19 April but without extending a long trough south-easterly and without coinciding with notable catches of migratory species. The next catch was one PDB with *C. argentifera* and 20 *U. pulchelloides* on 29 April-1 May as a long cold front extending northerly to the Northern Territory crossed Tasmania at 25 knots on 28 April. No more damsel bugs were caught in this year until 1 December 2000 as a trough extending to Alice Springs and a cold front passed.

The week 17-23 December 2000 did not coincide with any tropical cyclones, the last being TC Sam (4-10 December) and yielded five PDB on the night of 20 December and 10 the following night. This coincided with *U. pulchelloides*, a spike (69) of *P. xylostella* and many (18) *M. tasmaniae*. The synoptic chart for 21 December shows a northerly airflow across Tasmania ahead of a trough extending north -westerly to Surveyor General's Corner where it joined two subtropical troughs. The preceding trough and front that crossed Tasmania on 17 December coincided with peaks of *P. xylostella* and *M. tasmaniae* and the rarely seen species, *A. rubrescens*, *C. hades* but no damsel bugs. However a single damsel bug was caught the following night by which time another 35 knot cold front, preceding a trough that extended southwards into South Australia, had passed.

During the week 1-7 January 2001, catches of *C. hades*, *U. pulchelloides*, *C. argentifera*, *A. tenuis*, *D. gerula*, *A. ipsilon*, *A. infusa*, *A. munda*, *P. dyscrita*, many (35) *H. punctigera* and peaks of (165) *P. xylostella* and (17) *M. tasmaniae* overlapped with nine damsel bugs on 4-7 January. In this period two troughs and two cold fronts, without great northerly extension, passed Tasmania.

A major peak of 35 PDB in the week 19-25 February 2001 followed a week in which TC Vincent (12-15 February) developed north of Port Hedland and moved southeast to cross the coast and decay into a depression that interacted with another near Katherine to strongly influence weather for many days. The catches coincided with *C. argentifera*, *C. eriosoma*, *A. tenuis*, *U. pulchelloides*, *Proteuxoa poliocrossa*, *P. ochrias*, *Chasmina pulcra*, several *H. punctigera* but few *Agrotis* and no *P. ewingii* as well as an unprecedented catch of 176 black field crickets, *Teleogryllus commodus* (Walker). The cricket catch occurred 17-20 February and coincided with the unique catch of *C. pulcra* and the two rarely seen *Proteuxoa* species in a period when airflows changed from south-westerly to northerly. Many *Proteuxoa* are resident at Devonport and have regular, well defined univoltine peaks but a few are suspected of being occasional vagrants as was also suggested by Gregg *et al.* (1993) (as *Rictonis* spp.).

Large catches of PDB in the week 26 February – 4 March 2001 mostly occurred in two catch periods, 24-26 February (19) and 27 February (7) and coincided with a few migratory species, namely *U. pulchelloides* (3), *H. punctigera* (13), *P. xylostella* (10) as well a five *M. tasmaniae* and a couple of *Mallada*. This occurred while a 1005Mb low pressure system occurred north of Geraldton, WA and severe TC Abigail (22 Feb – 8 Mar) crossed the north Queensland coast extending troughs well southwards and a series of 30-40 knot cold fronts crossed Tasmania on 23, 24 and 26 February.

In the week 5-11 March 2001, 12 PDB were caught (3-5 March) coincidentally with the rarely seen *T.*

orichalcea as well as *U. pulchelloides, A. tenuis, P. ewingii, H. punctigera, P. xylostella, M. tasmaniae* and *Mallada*. Again on 21 and 22 March three PDB were trapped coincidentally with another *T. orichalcea*, 2 *A. ipsilon*, 11 *U. pulchelloides* and one *H. hydralis* as well as a few *C. argentifera, C. eriosoma* and *P. ewingii*. This occurred during passage of a cold front over Tasmania behind a trough extending north-westerly to Alice Springs while a low at Port Hedland caused rain from there to Alice Springs. These were the last PDB trapped until 1 October 2001 when one was caught coincidentally with *C. argentifera, A. tenuis, H. tonsa, A. infusa*, many (46) *A. munda, H. punctigera*, a peak of *P. xylostella*, many (41) *H. hydralis* and two *M. tasmaniae* followed the next night by *U. pulchelloides* and lesser numbers of most of the preceding species. This immigration occurred during warm airflows and thunderstorms associated with passage of a 20 knot front that extended north-westerly to Alice Springs behind a trough but in absence of any tropical depression near Port Hedland.

In January 2002, the small catches of PDB coincided with rarities like *P. dyscrita, R. falculalis, A. pauropis, P. inassueta, A. rubrescens* and the more common migrants, *A. tenuis, A. infusa, A. munda, H. punctigera* as well as suspected migratory *M. tasmaniae* and *Mallada*. The synoptic charts preceding the damsel bug catches (10-11 and 19-21 January) show 1004-6mb low pressure systems near Port Hedland prior to troughs forming diagonally across South Australia and the passage over Tasmania of 20-25 cold fronts with considerable northerly extent into the mainland.

In the week 12-18 March 2002, ten PDB were trapped coincidentally with *P. oxygona, C. argentifera, A. tenuis, A. infusa, A. munda, H. punctigera, H. hydralis, M. convecta* and a novel black *Ectopatria* species, perhaps *E. panrogramma*, but none in large numbers except for *H. punctigera*. The synoptic chart for 11 March shows a 1008mb low pressure system southeast of Port Hedland with a trough extending into the Great Australian Bight. This was followed by a 25 knot cold front compressing a northerly airflow over Tasmania. The smaller peak of damsel bugs in April 2002 coincided with *C. subsidens, A. infusa, H. punctigera, R. falculalis* as well as *M. tasmaniae* and *Mallada* after which no damsel bugs were trapped until February 2003.

In the week 26 March to 1 April 2003, five PDB were trapped coincidentally with *P. ewingii*, pale *H. punctigera* and *H. hydralis* two days after a catch of *A. ipsilon*. This period coincided with severe TC Inigo (30 Mar – 8 April), which was far northwest of Port Hedland and subsequently turned south-east to cross the coast on 8 April. However, a very long trough from Mt Isa to Melbourne coincides more closely with the catches PDB on 28 and 29-31 March. Soon after, no more damsel bugs were caught between 24 April and 16 November 2003.

In November 2003 the catches of PDB coincided with a series of influxes of *P. xylostella* and the passage of cold fronts behind troughs that extended northwesterly almost to Port Hedland. *P. ewingii, H. punctigera* and *H. hydralis* coincided with these catches in smaller numbers.

In the week 17-23 December 2003 the catch of 12 PDB occurred on the night of 18 December coincidentally with *R. eretmophora, U. pulchelloides, A. munda*, pale *H. punctigera*, many (112) *P. xylostella*, 30 *N. vinitor*, several *M. tasmaniae* and a rare catch of six Cydnidae. This event was preceded by 1003-8mb low pressure systems over central and western Australia extending a trough well south and followed by a 30 knot cold front which slipped south-easterly below Tasmania.

In the following week of 24-31 December, a catch of seven PDB on the night of 30 December coincided with *A. tenuis, H. hydralis, U. pulchelloides*, many (98) *P. xylsostella* and a few *N. vinitor*. This occurred as a 35 knot cold front moved across Tasmania behind a through that extended north-westerly to a 1007mb low near Alice Springs so that a strong northerly airflow occurred over Tasmania during the catches.

From January to April 2004 several peak catches of PDB coincided with many migratory or vagrant species as mentioned above. Catches of damsel bugs on 24, 29 and 31 March coincided with severe

TC Fay crossing inland near Port Hedland and extending a trough well south and may relate respectively to the passage of three cold fronts during the period.

Notably, the influx of migratory *U. pulchelloides* from the north in January 2004 (Hill, 2011) was interrupted at the end of January by a week of easterly storms that carried currant lettuce aphid, *Nasonovia ribisnigri* (Mosley) Riley from New Zealand to Tasmania.

The week 23-29 April 2004 when two PDB were caught was notable for the coincidental catch of many green mirids, *C. dilutus* as well as *A. tennis, P. dyscrita, U. pulchelloides* and *H. hydralis*. This occurred during passage of a 30 knot cold front behind a trough that extended north-westerly into Western Australia but in the absence of an obvious low pressure centre near Port Hedland. After this event no PDB were trapped until 15 November, when cool westerly airflows occurred for three days after passage of a trough and cold front. During this period a large migration of several Noctuidae and *P. xylostella* was reported across South Australia and Victoria around 23-27 August (P. Ridland, pers. comm) but was not detected in the Stony Rise light trap.

During 2005 the larger catches of PDB coincided with many of the species previously mentioned. Catches on 9, 10, 13 and 14 April occurred during a prolonged period of *U. pulchelloides* immigration as well as another rare appearance of 31 *C. dilutus* on 10 April and *E. huegeliana* on 13 April. In September the single catches of damsel bugs (12 and 19 September) closely followed the rare appearance of three *H. punctifera* on 9 September. A massive migration of this species was reported across South Australia nine days earlier on 29 August (G. Baker, pers. Comm.) but only a few *A. munda, A. infusa* and *P. xylostella* plus one novel unidentified noctuid moth were caught in the light trap at that time. The largest catch in 2005 of nine PDB occurred on the night of 2 November during storms coincidentally with an unusual catch of 67 *N. vinitor* that subsequently was reflected in many public reports of swarms of these bugs from Wynyard to Port Sorell along the north-west coast of Tasmania. The only other coincidental likely migrants were 23 *P. xylostella* and four *P. ewingii* as well as one *M. tasmaniae*. The synoptic chart for 2 November shows a 1008mb low pressure system near Port Hedland, two lows (1006-8mb) near Alice Springs with a trough extending south to Adelaide where a 1005mb low occurred with its trough extending well south easterly. This created a northerly airflow over Tasmania during the catches.

In 2006 the catches of 2, 1 and 13 PDB on 23, 25 and 27 January respectively, occurred during hot northerly airflows coincidentally with *A. munda, C. argentifera, A. tennis, P. ewingii, H. punctigera, M. convecta, P. xylostella, D. gerula* as well as 11 *M. tasmaniae* and some *Mallada*. The first catch appears related to TC Daryl near Port Hedland extending a trough well south towards Tasmania and the passage of a 20 knot cold front. The third catch appears related to a trough extending from Surveyor General's Corner to the south-west of Tasmania as a cold front approached at 20 knots from the west. One PDB was caught on the night of 7 February and 11 the following night coincidentally with *C. argentifera, H. punctigera, P. xylostella*, the rarely seen species, *C. subsidens, R. falcalalis* and *H. tonsa* as well as a couple of *M. tasmaniae*. In this period a trough extended from Surveyor Generals Corner southwards as a 20 knot front passed and was quickly followed by a 40 knot front behind another trough extending further northwards into Western Australia. The penultimate large catch of 2006 was 11 damsel bugs on the night of 21 February and occurred as a trough extended from Victoria to a 1007mb low near Mt Isa and a 30 knot cold front slipped past southern Tasmania. This was three days before TC Kate (22-23 February) formed at the tip of Cape York Peninsula. *C. argentifera, H. punctigera* and *R. falcalalis* coincided with this catch. A catch of 8 PDB bugs in the period 25-27 February 2006 coincided with only a few of the species previously mentioned but unusually with 60 small black unidentified Lygaeidae. Catches of PDB on the nights of 1 and 2 March occurred as TC Emma crossed southerly inland across Western Australia degrading into a low that then crossed the coast again into the Great Australia Bight ahead of a front so that northerly airflows occurred over Tasmania during the catches which coincided with only a few *C. argentifera, A. tennis* and *H. hydralis*.

Table 2 Weekly summary of catches of *Nabis kinbergii* in light trap at Stony Rise. Weeks from 21 May to 9 September are nil except 18-24 June 2005 (1 PDB). Asterisks denote weeks analysed in the text; -, no data.

Nabis SRC-MV	1999 /00	2000 /01	2001 /02	2002 /03	2003 /04	2004 /05	2005 /06	2006 /07	mean 2000-07	2010 /11
10-16 September	-	0	0	0	0	0	1*	0	0.1	0
17-23 September	-	0	0	0	0	0	1*	0	0.1	0
24-30 September	-	0	0	0	0	0	0	0	0.1	0
1-7 October	-	0	1*	0	0	0	0	0	0.1	0
8-14 October	-	0	0	0	0	0	0	0	0	0
15-21 October	-	0	0	0	0	0	0	0	0	0
22-28 October	-	0	0	0	0	0	0	0	0	0
29 Oct - 4 Nov	-	0	0	0	0	0	9*	0	1.3	0
5-11 November	-	0	0	0	0	0	0	.0	0	0
12-18 November	-	0	1	0	1*	1*	0	0	0.4	1
19-25 November	-	0	0	0	3*	0	0	0	0.4	0
26 Nov - 2 Dec	-	1	0	0	1	0	0	0	0.3	46
3-9 December	-	1	0	0	0	0	0	0	0.1	0
10-16 December	-	1	0	0	0	0	0	0	0.1	0
17-23 December	-	17*	0	0	12*	2	0	0	4.4	0
24-31 December	-	0	0	0	7*	0	2	0	1.3	0
1-7 January	0	9*	0	0	2	0	3	-	1.9	0
8-14 January	0	0	1*	0	0	3*	3	-	1.0	0
15-21 January	3*	0	1*	0	1*	3*	2	-	1.4	0
22-28 January	2*	4	0	0	4*	0	15*	-	3.6	1
29 Jan - 4 Feb	2*	2	1	0	5*	0	4	-	1.9	9
5-11 February	3*	2	1	1	7*	0	12*	-	3.7	1
12-18 February	1	4	0	0	1	1	2	-	1.3	0
19-25 February	0	35*	0	0	4*	1	16*	-	8.0	1
26 Feb - 4 Mar	5*	21*	0	0	1	0	11*	-	5.4	1
5-11 March	11*	6*	1	0	0	0	0	-	2.5	7
12-18 March	1	2	10*	0	1	1	0	-	2.1	1
19-25 March	0	3*	1	0	2*	0	0	-	0.9	1
26 Mar - 1 Apr	0	0	0	5*	4*	0	1	-	1.4	0
2-8 April	0	0	0	0	0	0	0	-	0	0
9-15 April	5*	0	1	0	0	4*	0	-	1.4	0
16-22 April	0	0	2*	0	0	0	0	-	0.3	0
23-29 April	0	0	2*	1	2*	1	0	-	0.9	0
30 Apr - 6 May	1*	0	0	0	0	2	0	-	0.4	0
7-13 May	0	0	0	0	0	0	0	-	0	0
14-20 May	0	0	0	0	0	1	0	-	0.1	0
annual sum	-	108	24	7	58	21	82	-	47	69

Generation duration

A thermal summation program was used to model the likely fate of PDB generations in various seasons. Samson and Blood (1979) provided a thermal development model for the immature stages of PDB and indicated that adult female maturation required 5 days at 28°C and 24 days at 18°C. An assumption is made here that female maturation requires 60DD on base of 11.3°C, which is partly based on Guppy (1986) who elaborated work by Braman and Yeargan (1988) for American species of

Nabis in which the lower developmental threshold for female maturation was unclear, especially for overwintered females. In the model, this yields female maturation duration of 10 days at an average temperature of 18°C. Thermal summation using 30-year (1980-2010) daily average air temperatures for Launceston, yields consecutive generation scenarios (commencing with an immature adult) of 1 September – 5 January (126 days), 5 January – 12 March (68 days) and 12 March – 24 October (227 days). So, it is conceivable that PDB could complete two generations in the warm season and overwinter as a third in Tasmanian agricultural localities with a relatively warm summer albeit relatively cool winter, such as the Tamar Valley and northern midlands.

Application of the same model to Forthside on the north-west coast of Tasmania, which has a cooler maritime summer but warmer winter (but using 1980s temperature data), yields slower generation scenarios of 1 September – 7 February (159 days), 7 February – 27 August (203 days) and 27 August – 6 February (164 days). The fastest generation would be about 100 days, commencing 1 January. The Forthside climate is similar to Kindred where, as mentioned above, nymphs were collected in a carrot crop in mid-May and early June, suggesting they grew from eggs laid in February-March. Outputs of this thermal development model are very sensitive to assumptions made for lower thresholds and linear development, such as adult female maturation, given that temperatures are near the assumed base for prolonged periods of each year.

Discussion

The coincidence of nearly all catches with northerly airflows and known migrants or rare vagrants suggests that the Stony Rise light trap does not detect local populations of PDB so that only direct monitoring of crops will provide information immediately useful in pest management. The impact of these frequent but erratic immigrations on local population levels remains unknown. The reproductive status of light trapped individuals was not investigated although 24 female specimens have been retained in the DPIPWE collection. The paucity of spring field observations of PDB leaves the question of whether PDB overwinters strongly in Tasmania unanswered although heat unit modelling suggests 2-3 annual generations including overwintering are feasible.

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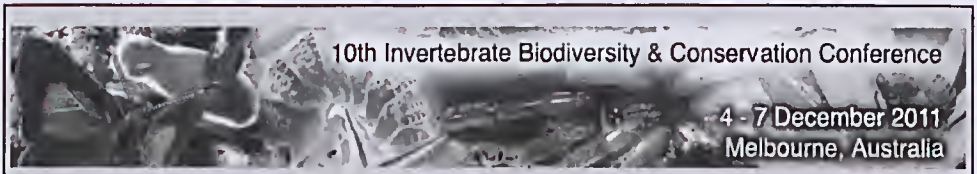
Members are invited to send photos or drawings that may be suitable for the cover of future newsletters.

Note that from Feb 2012 bulletins will be produced in colour. This will provide scope to utilize colour photos on each cover and style may be different from what we have used in the past.

As the spring and summer seasons develop don't forget to send in your observations of insect events for the bulletin.



On behalf of the organising committee, we extend a warm invitation to you to attend the combined 10th Invertebrate Biodiversity & Conservation / Society of Australian Systematic Biologists Conference. It will be held in Melbourne, Victoria, from Sunday December 4th - 7th 2011, with a national invertebrate conservation workshop on Thursday December 8th. The conference will bring together researchers (scientists and students) from a broad range of interests to discuss the latest research in invertebrate conservation, biodiversity, ecology and systematics.

The conference will run several symposia with themes of major importance. Intending delegates are encouraged to submit papers/posters on their own areas of expertise and interest as the overall program will be designed to cover a much broader range of topics. http://ibcc2011.org/

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